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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]Device structure of this invention is simple and it relates to the solid oxide fuel cell which can reduce internal resistance easily. By this invention, it makes it possible to generate electricity stably also in fuel gas and the mixed gas of air in more detail.

Therefore, it is not necessary to remove gas-seal material and a separator from a device conventionally, and to thin-film-ize an electrolyte by a special method, and is related with the new high temperature form fuel cell which can generate a useful chemical by the substitute which does not discharge carbon dioxide simultaneously.

[0002]

[Description of the Prior Art]If the conventional solid oxide fuel cell is not a barrier membrane method which supplies air to an anode room independently in fuel gas including methane, and a cathode room, It was not able to generate electricity (energy resources, Vol.13, No.3, 36-43 (1992), and JP,H5-74468,A).

[0003]For this reason, gas-seal material and a separator were needed and the life of the cell was short by the solid phase reaction between a device not only becoming complicated but (JP,H5-62692,A and JP,H5-62693,A), and these ceramics materials.

[0004]In order that the conventional solid oxide fuel cell may lower the internal resistance, A solid electrolysis film must be thin-film-ized to a thickness of several micrometers by a special method, Are thereby very expensive. It was (Proceedings of the.). third international. symposium on solid oxide. fuel celles, edited by S.C.Singhal Westinghouse Scienceand Technology Center, Pittsburgh, Pennsylvania, USA, 665-781 (1993).

[0005]Since the conventional solid oxide fuel cell had transformed the energy of the perfect combustion of methane into electric power, it had discharged the carbon dioxide which is a causative agent of global warming. In addition, although alumina is used as an electrolyte, platinum and SrRuOx are used as an electrode and the cell which introduces the mixed gas of hydrogen and oxygen is also developed about the room temperature type fuel cell, these belong to what is called the first generation fuel cell.

The thing of this invention differs in basic constitution.

[0006]

[Problem(s) to be Solved by the Invention] This invention persons have the device structure which lessened the ceramic component as much as possible in view of the above-mentioned conventional technology, Can reduce internal resistance by an easy method cheap moreover, and the carbon dioxide which is a causative agent of global warming simultaneously is not discharged, The result of having repeated examination for the purpose of developing the fuel cell which generates a more useful chemical, Palladium, platinum and nickel, or a rhodium electrode and a gold electrode are printed on stabilized zirconia or the same surface of the electrolyte sheet of a perovskite type oxide, and it finds out that the desired end is attained by introducing the mixed gas of low grade hydrocarbon and air, and came to complete this invention.

[0007] The issue which this invention tends to solve is constituting the new fuel cell which does not need to remove gas-seal material and a separator from a device, does not need to thin-film-ize an electrolyte by a special method, and can reduce the discharge of carbon dioxide simultaneously.

[0008] That is, an object of this invention is to provide the high temperature form fuel cell which made possible chemical cogeneration by generation of a long life by simple [of device structure], the low cost by the unnecessary nature of electrolyte-thin-film-izing, the environmental protection by the low ecritic nature of carbon dioxide, hydrogen, and carbon monoxide, etc.

[0009]

[Means for Solving the Problem] This invention prints two electrodes from which catalyst ability is different to partial oxidation reaction of hydrocarbon on the same surface of an electrolyte sheet, and enables it to generate them also in fuel gas and mixed gas of air. Namely, a mode of this invention for solving an aforementioned problem, It has a simple structure which printed palladium, platinum and nickel, or a rhodium electrode and a gold electrode on stabilized zirconia or the same surface of a solid electrolyte sheet of a perovskite type oxide, a non-barrier membrane type solid oxide fuel cell which voltage is obtained and can take out current stably also in uniform gas by introducing mixed gas of low grade hydrocarbon including methane, and air -- it comes out.

[0010] In this invention, a ceramics sheet of stabilized zirconia or a perovskite type oxide is used as an electrolyte. Stabilized zirconia replaces some tetravalent zirconium ion of zirconium oxide by trivalent yttrium ion, A perovskite type oxide replaces a part of tetravalent cerium ion of cerium oxide barium with trivalent ion including yttrium ion. Pressing of these is carried out, it sinters at 100 times more than 1000, and a 1-mm-thick sheet is formed. Serialization of a fuel cell is possible by printing palladium, platinum and nickel, or a rhodium electrode and a gold electrode with screen-stencil or vacuum deposition on the same surface of a solid electrolyte sheet, and connecting between each cell by interconnector. Parallelization of a fuel cell is possible by printing these electrodes on a table of an electrolyte sheet, and hidden both sides by turns, and connecting inter-electrode [with an end of a table and a rear face / same] by interconnector. Gold should just be used for a means to connect between each cell, as interconnector like an electrode, and it does not need a new material. Especially distance between above-mentioned palladium, platinum and nickel, or a rhodium electrode and a gold electrode is raised as an example with 1 mm - preferred 1 micrometer, although not limited.

[0011] In this invention, the above-mentioned device is heated to a high temperature region of 700-1000 ** as an operating condition, Mixed gas with optimal composition ratio in which partial oxidation reaction of each low grade hydrocarbon and oxygen occurs is introduced, electric power is taken out from a cell output terminal, and hydrogen and carbon monoxide are simultaneously collected from a cell exit. Although

methane, ethane, and propane are raised as a suitable thing as the various above-mentioned hydrocarbon, if it is a thing of not only this but this, and the effect, it cannot be overemphasized that it can be used similarly.

[0012]

[Function]By introducing the mixed gas of low grade hydrocarbon and air at an elevated temperature (700-1000 **), it is possible for a fuel cell to be generated in spite of the inside of fuel gas and the mixed gas of air. Thereby, it becomes possible only by narrowing two inter-electrode distance to decrease the internal resistance of a cell, without thin-film-izing a solid electrolyte unlike the conventional fuel cell. By connecting between each cell on the same surface by interconnector, by connecting inter-electrode [that voltage is added, and the serialization of of a cell is attained, in addition is in the end of the surface and a rear face / same] by interconnector, the internal resistance of a cell can be reduced and parallelization of a cell is attained. By generating a fuel cell, it is possible to obtain hydrogen and carbon monoxide simultaneously with electric power, as an outlet gas ingredient at the time of battery discharge, hydrogen and carbon monoxide are generated and not only reducing emission of carbon dioxide but chemical cogeneration is made possible.

[0013]

[Example]Next, although working example of this invention is concretely described based on Drawings, this invention is not limited only to the working example concerned.

Working example 1 drawing 1 is an example of working example of this invention device, and 1 is a solid electrolyte sheet which comprises stabilized zirconia and a pro Bus Kite type oxide.

2 is an electrode which has catalyst ability in the partial oxidation reaction of hydrocarbon including palladium, platinum and nickel, or rhodium, 3 is an electrode without catalyst ability including gold, 4 is interconnector which connects between cells and they have arranged it by turns.

[0014]This device was heated from 1000 ** to 7000 **, and fuel gas and the mixed gas of air were introduced from this side.

[0015]As working example, the result at the time of introducing methane and air mixed gas (methane: oxygen ratio =2:1) into the fuel cell of electrolyte sheet 9 mm square and each electrode area [of 0.09 cm]² at the temperature of 950 ** is shown below.

[0016]In spite of the inside of mixed gas, the voltage of several 100 mV occurred from the cell, and, moreover, current was able to be stably taken out so that the discharge curve of the cell of drawing 2 might show.

[0017]By narrowing two inter-electrode distance showed that inclination of a current-voltage curve became small and the internal resistance of the cell decreased.

[0018]Two cells on the same surface were added to voltage by every *****, and the in-series effect showed up on the cell so that the discharge curve of the in-series cell of drawing 3 might show.

[0019]By every *****, the internal resistance of the cell could be reduced and the parallel effect showed up two cells, the surface and a rear face, on the cell so that the discharge curve of the parallel batteries of drawing 4 might show.

[0020]As a discharge product, hydrogen and carbon monoxide are with *****, and carbon dioxide had not carried out deer generating only so that the outlet gas presentation at the time of this fuel cell discharge of

Table 1 might show.

[0021]

[Table 1]

本燃料電池放電時のガス組成							
	メタン	酸素	窒素	水素	一酸化炭素	二酸化炭素	その他
入口	40%	20%	40%	0%	0%	0 %	0 %
出口	23%	8%	40%	8%	2%	0.5%	19.5%

[0022]

[Effect of the Invention]As explained above, the fuel cell of this invention has a repercussion effect which the low eccritic nature of of simple [of device structure], the unnecessary nature of electrolyte-thin-film-izing, and carbon dioxide, etc. become possible, and makes utilization of a fuel cell easy, and extends the setting position and use use.

[Translation done.]